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MATERIEL MANAGEMENT ANALYSIS

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DEVELOPMENT OF STANDARD SPARES
PROJECTION FACTORS

Mr Rob Lucas
HQ AFLC/MMISA
June 1989

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COMBAT STRENGTH THROUGH LOGISTICS
LOGISTICS SUPPORT THROUGH ANALYSIS

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DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE LOGISTICS COMMAND
WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433-5001

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REPLY TO
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SUBJECT Final Report - Development of Standard Spares Projection Factors

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1. This report documents our attempt to update Systems Support Division (SSD) standard spares projection factors. The report describes the need to update the factors to reflect initial provisioning for new weapon systems, and identifies some problems with data sources needed to develop commodity based factors. Also, it describes the need to examine demand-based approaches to computing SSD initial spares dollars. We provide our conclusions and recommended actions at Atch 1.

2. Our point of contact is Mr Rob Lucas, HQ AFLC/MMISA, AUTOVON 787-5429.

FOR THE COMMANDER

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DCS/Materiel Management

3 Atchs

1. Conclusions and Actions
2. Distribution List
3. Final Report



COMBAT STRENGTH THROUGH LOGISTICS

CONCLUSIONS AND ACTIONS

Conclusions

1. We found no way to accurately update Systems Support Division (SSD) initial spares factors by the commodity groups given in AFLCR 67-7 because no such break outs exist in the accounting records for SSD items.
2. We found no way to accurately compute SSD initial spares factors by acquisition milestones from current accounting records.
3. A demand-based, item level provisioning approach for SSD initial spares requirements projections may be necessary for budgeting and funding purposes.
4. SSD budget managers are concerned on how to handle Program Objective Memorandum (POM) forecasts for initial spares requirements with a demand-based budgeting approach.
5. If SSD budget managers adopt a demand-based initial provisioning approach, it will mean changing and updating the AFLCR 67-7, Stock Fund Initial Spare Requirements regulation.
6. Any new approach to develop projections for SSD initial spares provisioning will need to examine force modernization, weapon system modifications, follow-on support, and common item support.
7. SSD initial spares factors can be developed for common item support from H057 data.
8. With AFLC's current emphasis on individual weapon system management, factors by mission design (MD) may be more desirable than a commodity factor approach.
9. The ALCs do not consistently conform to policy on the use of the Control System Number (CSN) and Material Program Code (MPC) codes. Also, SM-ALC's H057 2DI Systems Support Stock Fund Status report contains only two years of data broken out to the CSN level as opposed to three years for the other ALCs. SSD budget managers have stated that the third year's data is the most accurate look at the SSD's obligated dollars.

Actions

1. Initiate a follow-on project to examine SSD initial spares provisioning for force modernization, weapon system modifications, follow-on support, and common item support. (OPR: AFLC/MMISA, OCR: AFLC/MMMSS)
2. Examine the initial spares budgeting hypothesis that "a direct relationship exists between a federal stock class (FSC) mean time between demand (MTBD), unit price, and initial spares cost" for SSD initial spares budgeting requirements. (OPR: AFLC/MMISA, OCR: AFLC/MMMSS)

3. Develop analytical procedures to estimate the Program Objective Memorandum (POM) forecasts for initial spares requirements with a demand-based budgeting approach. (OPR: AFLC/MMISA, OCR: AFLC/MMMSS)
4. Document the SSD initial spares, demand-based, budgeting approach. (OPR: AFLC/MMISA, OCR: AFLC/MMMSS)
5. Develop a factor for common items from the current H057 data base. (OPR: AFLC/MMISA, OCR: AFLC/MMMSS)
6. Determine an SSD initial spares provisioning approach by mission design (MD) for SSD budgeting requirements. (OPR: AFLC/MMISA, OCR: AFLC/MMMSS)
7. Reinforce current policy to ensure standardized use of provisioning codes at the different ALCs. Have SM-ALC standardize the number of years data in their 2DI reports from two to three years. (OPR: AFLC/MMMSS, OCR: AFLC/MMISA)

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ABSTRACT

This report documents our attempt to update Systems Support Division (SSD) standard spares projection factors for estimating initial spares requirements for budgeting and funding purposes. The factors currently used can be found in AFLCR 67-7, Stock Fund Initial Spares Requirements. The report describes the need to update the factors to reflect initial provisioning for new weapon systems, and identifies some problems with data sources needed to develop commodity based factors. Finally, the report describes the need to examine demand-based approaches to computing initial spares.

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EXECUTIVE SUMMARY

The Air Force uses standard spares projection factors to estimate Systems Support Division (SSD) initial spares consumable requirements as a function of end item cost. These factors are used for new weapon system acquisitions as well as force modernization and modification programs. The current spares factors are outdated and (before managerial review) resulted in unreasonably high requirements for initial spares. In this study, we document our efforts to develop updated factors by airframe, engines, peculiar support equipment, electronics, and trainers/simulators.

In our analysis, we attempted to derive the factors from the H057 and H058 Central Procurement Accounting System reports. However, we could not develop the factors by commodity groups (i.e., by airframe, engines, etc.) from the data. A new approach is needed. SSD budget managers stated that any new approach will need to address initial spares provisioning for force modernization (introducing new weapon systems to the Air Force inventory), weapon system modifications, any follow-on support (provisioning for increasing current weapon system inventories), and for common item support.

Currently, the Air Force Logistics Command (AFLC)/Air Force Systems Command (AFSC) Initial Spares Working Group is examining initial spares policy. An objective of this group is to examine a demand-based approach to computing initial spares requirements based on the federal stock class (FSC) mean time between demand (MTBD), unit price, and the initial spares costs. We recommend examining such an approach for developing the consumable initial spares requirements.

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CHAPTER 1

THE PROBLEM

The Air Force uses standard spares projection factors to estimate initial spares consumable requirements as a function of end item cost. These factors are used for new weapon system acquisitions as well as force modernization and modification programs. We need to update the initial spares factors.

Background

Spares factors are used to compute the Systems Support Division (SSD) consumable item projection requirements used for repair of a new end item. Since individual item costs are unavailable when projecting initial spares requirements, the requirements are determined by multiplying total hardware costs (i.e., end item cost) by the spares factor. The current SSD factors break out the initial spares by airframe, engines, peculiar support equipment, electronics, and trainers/simulators. These factors are outdated and (before managerial review) resulted in unreasonably high requirements for aircraft initial spares. Original analysis on how the current factors were developed is unavailable and is probably tied to the procurement of older weapon systems. We need new standard spares factors that will reflect today's modern weapon systems.

Objectives

1. Determine standard spares projection factors for budgetary requirements.
2. Document the methodology for incorporation into the Requirements Data Bank PPBS subsystem.

CHAPTER 2

ANALYSIS

Overview

We document our study in three sections. First, we examine developing factors from available data by commodity breakouts. Then we examine an alternate approach of developing factors by acquisition milestone. Lastly, we look at issues uncovered in our analysis.

Developing Factors by Commodity Breakout

The policy and procedures for computing Systems Support Division (SSD) stock fund requirements for budgeting and funding purposes are found in AFLCR 67-7, Stock Fund Initial Spare Requirements [1]. According to this regulation, the SSD budget manager should use the following factors from this regulation to determine budget requirements for SSD initial spares.

STANDARD SPARES FACTORS (By Commodity Group)

Airframe	4.5 %
Engine	3.0 %
Support Equipment	2.0 %
Electronics	5.0 %
Trainers/Simulators	1.0 %

Table 2-1

The factors in Table 2-1 are applied to compute requirements for aircraft production, missile production, communications-electronics, class IV and V modifications, and all other types of items. The factors are applied to the projected unit cost of the end item in the following manner:

Initial Spares Requirement (\$) =

End Item Deliveries (during the initial support period (ISP))

X End Item Unit Cost

X Appropriate Spares Factor

Depending on the type of end item, the ISP is the first year or the first and second year of end item deliveries. For example, for aircraft production, the ISP is the first two years of aircraft deliveries.

Looking at the above equation, we can easily determine the factor as a function of historical SSD initial spares provisioning dollars and end item delivery dollars, as shown below.

$$\text{Factor} = \frac{(\text{SSD Initial Spares Requirement (\$)})}{(\text{End Item Deliveries X End Item Unit Cost})}$$

The dollars in the numerator and denominator can be found in the Central Procurement Accounting System (H057 and H058) reports. We identified the H057 2D1 Systems Support Stock Fund Status report for SSD provisioning data. For the end item delivery data, we identified the H058 7B2 Status of Allotment/Allocations Report.

We identified a number of problems with the available data. The most serious problem we encountered was that the H057 data does not allow for any kind of commodity breakouts. In the H058 reports, the Material Program Code (MPC) is used to identify commodity breakouts of the funding. In H057, the MPC identifies the usage of the funding (e.g., for provisioning, for operations, for repair, etc.). Therefore, we cannot develop factors for commodity breakouts as originally planned. The best we can do from H057 and H058 is to develop factors by weapon system at the mission design (MD) level. However, even this approach may be difficult to accomplish from the H057 data, since we cannot guarantee proper matching of the SSD provisioning data to end item delivery data in the 7B2 reports, which is necessary to develop dependable factors. Appendix A contains a more detailed look at the H057 and H058 reports.

Developing Factors by Acquisition Milestone

In a subsequent investigation for new or better data sources from which we could develop commodity factors, we talked to SSD budget managers at OC-ALC and SA-ALC. No new data sources were found. Furthermore, we discovered that the Air Logistics Center's (ALC) budget managers believe the current factor methodology is too rigid for requirements determination. We illustrate this in Figure 2-1 and describe it in the following paragraph.

INITIAL SPARES REQUIREMENTS BY ACQUISITION MILESTONE

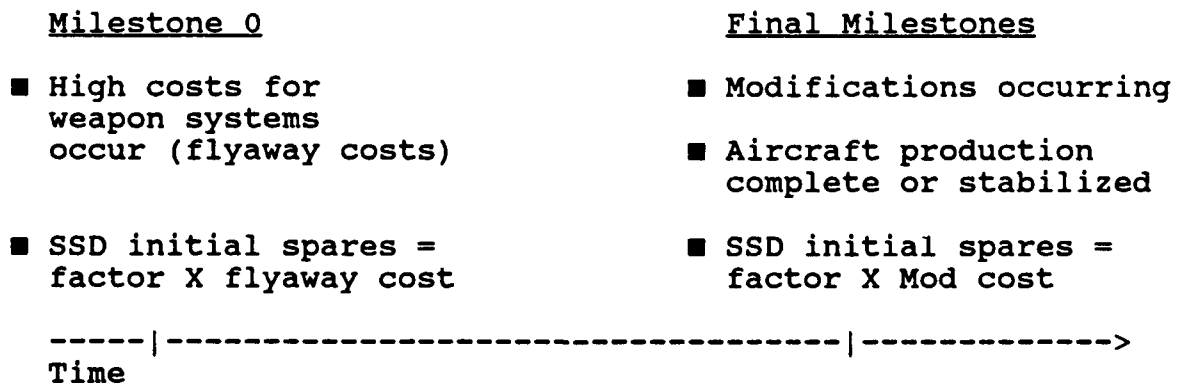


Figure 2-1

Recall that the SSD initial spares requirement for a particular end item is computed by multiplying the initial spares factor by the end item cost, as shown at the bottom of Figure 2-1. A big problem with this methodology occurs when large shifts occur in the end item costs across the weapon system's production period. The same factor is used across time and is multiplied by widely varying end item costs. This leads to requirements that are too high for early acquisition milestones, and too low for later provisioning efforts such as modifications. This factor problem has led to work-arounds by budget managers where they have subjectively changed the requirement as the particular circumstances dictated. Because of this, the budget managers indicated that a schedule of factors by acquisition milestone is desirable.

When we examined the H057 data and the H058 data, there was no way to determine a match between the timing of the SSD dollars and the end item deliveries. Because of this, no accurate schedule of factors can be developed. Another data problem is that SSD H057 data does not stratify provisioning dollars before 1984 (i.e., by force modernization, force modifications, etc.). This means we cannot identify the appropriate early provisioning milestone dollars for the C-5, B-1 and other major end items.

Summary

Using the accounting data that is currently available, we cannot update or develop factors by commodity breakouts as they currently exist in AFLCR 67-7. Neither can the data be used to develop factors by acquisition milestone. A new approach is needed. The HQ AFLC SSD budget manager requires that any new approach will need to address initial spares provisioning for force modernization (introducing new weapon systems to the Air Force inventory), weapon system modifications, any follow-on support (provisioning for increasing current weapon system inventories), and for common item support.

Issues

Data Problems

When we examined the H057 2D1 reports for the different ALCs, a number of problems were apparent. The major problem was conformity with policy on the use of the Material Program Code (MPC) and the Control System Number (CSN) code. Current policy needs to be reinforced to ensure a standardized use of the codes at the different ALCs. Also, SM-ALC's 2D1 report contains only two years of data broken out to the CSN level as opposed to the three years for all the other ALCs. SSD budget managers have stated that the third year's data is the most accurate look at the SSD's obligated dollars. SM-ALC should standardize their report to that of the other ALCs.

Common Items

The issues we now present deal with possible new approaches to develop provisioning projections for SSD spares. For common item support, budget managers use a factor multiplied by the total provisioning budget for peculiar items. We could develop a factor for common items from the current H057 data base. We can identify the total provisioning dollars and provisioning for common items by the MPC and the CSN codes on the H057 reports.

Demand-based Approaches

For provisioning requirements for force modernization, weapon system modifications, and follow-on support, a demand-based, item level requirements approach may be necessary for budgeting and funding purposes. It appears that budget program managers for BP16 (aircraft initial spares) are moving in this direction for their requirements determination. Currently, they use budgeting factors in a similar manner as used by SSD budget managers. However, due to a hypothesis being examined by the Air Force Logistics Command (AFLC)/Air Force Systems Command (AFSC) Initial Spares Working Group, the initial spares budgeting objective is "a direct relationship exists between a federal stock class (FSC) mean time between demand (MTBD), unit price, and initial spares costs" [2]. This means that initial spares requirements ought to be based on these three components. We should examine this approach for SSD initial spares budgeting requirements.

One concern raised by SSD budget managers is how to handle Program Objective Memorandum (POM) forecasts for initial spares requirements with a demand-based budgeting approach. Though the new approach appears to be vastly different from current POM projection methodologies, it would actually be similar to how requirements are now projected. Currently, the budget manager determines requirements by the factors for the ISP and follow-on periods of weapon system production. This is then budgeted into the POM outyears. Instead of using the commodity factors, the requirement would now be demand-based. We should examine SSD initial spares POM forecasts under a demand-based budgeting approach.

Another issue in developing a demand-based approach for SSD initial spares requirements will be the rewriting of the AFLCR 67-7. We have already shown that the factors in the regulation are unusable and should be rescinded. If a demand-based approach is adopted, it may mean changing portions of the regulation. We should clearly document any further analysis so SSD budget managers can incorporate it into the regulation.

Weapon System Management

One last issue we need to consider is AFLC's current emphasis on individual weapon system management. Initial spares factors by weapon system or mission design (MD) may be more desirable than a commodity factor approach. We recommend that such an approach should be adopted for SSD budgeting requirements.

CHAPTER 3

CONCLUSIONS AND ACTIONS

Conclusions

1. We found no way to accurately update Systems Support Division (SSD) initial spares factors by the commodity groups given in AFLCR 67-7 because no such break outs exist in the accounting records for SSD items.
2. We found no way to accurately compute SSD initial spares factors by acquisition milestones from current accounting records.
3. A demand-based, item level provisioning approach for SSD initial spares requirements projections may be necessary for budgeting and funding purposes.
4. SSD budget managers are concerned on how to handle Program Objective Memorandum (POM) forecasts for initial spares requirements with a demand-based budgeting approach.
5. If SSD budget managers adopt a demand-based initial provisioning approach, it will mean changing and updating the AFLCR 67-7, Stock Fund Initial Spare Requirements regulation.
6. Any new approach to develop projections for SSD initial spares provisioning will need to examine force modernization, weapon system modifications, follow-on support, and common item support.
7. SSD initial spares factors can be developed for common item support from H057 data.
8. With AFLC's current emphasis on individual weapon system management, factors by mission design (MD) may be more desirable than a commodity factor approach.
9. The ALCs do not consistently conform to policy on the use of the Control System Number (CSN) and Material Program Code (MPC) codes. Also, SM-ALC's H057 2D1 Systems Support Stock Fund Status report contains only two years of data broken out to the CSN level as opposed to three years for the other ALCs. SSD budget managers have stated that the third year's data is the most accurate look at the SSD's obligated dollars.

Actions

1. Initiate a follow-on project to examine SSD initial spares provisioning for force modernization, weapon system modifications, follow-on support, and common item support. (OPR: AFLC/MMISA, OCR: AFLC/MMMSS)
2. Examine the initial spares budgeting hypothesis that "a direct relationship exists between a federal stock class (FSC) mean time between demand (MTBD), unit price, and initial spares cost" for SSD initial spares budgeting requirements. (OPR: AFLC/MMISA, OCR: AFLC/MMMSS)

3. Develop analytical procedures to estimate the Program Objective Memorandum (POM) forecasts for initial spares requirements with a demand-based budgeting approach. (OPR: AFLC/MMISA, OCR: AFLC/MMMSS)
4. Document the SSD initial spares, demand-based, budgeting approach. (OPR: AFLC/MMISA, OCR: AFLC/MMMSS)
5. Develop a factor for common items from the current H057 data base. (OPR: AFLC/MMISA, OCR: AFLC/MMMSS)
6. Determine an SSD initial spares provisioning approach by mission design (MD) for SSD budgeting requirements. (OPR: AFLC/MMISA, OCR: AFLC/MMMSS)
7. Reinforce current policy to ensure standardized use of provisioning codes at the different ALCs. Have SM-ALC standardize the number of years data in their 2D1 reports from two to three years. (OPR: AFLC/MMMSS, OCR: AFLC/MMISA)

APPENDIX A

DATA RESEARCH RESULTS

H057 AND H058 ACCOUNTING SYSTEM RECORDS

APPENDIX A

DATA RESEARCH RESULTS: H057 AND H058 ACCOUNTING SYSTEM RECORDS

Overview

We document the data research in three sections. First we look at the background for the data research. Second we examine the details of the data reports. Then we look at the results of our data research.

Background

In developing SSD standard spare projection factors to estimate initial spares consumable requirements for budgeting and funding purposes, we determined that the factor is a function of SSD initial spares provisioning dollars and end item delivery dollars, as shown below.

$$\text{Factor} = \frac{(\text{SSD Initial Spares Requirement (\$)})}{(\text{End Item Deliveries X End Item Unit Cost})}$$

The dollars in the numerator and denominator can be found in the Central Procurement Accounting System (H057 and H058) reports.

In developing initial spares factors by commodity groups, we initially concentrated on developing factors for the B-1 and C-5 aircraft. In this manner, we could investigate the available data to compute the factors. We identified the H057 2D1 Systems Support Stock Fund Status report for SSD provisioning data. The 2D1 report contains the obligated dollars for initial provisioning of SSD spares. For the end item delivery data, we identified the H058 7B2 Status of Allotment/Allocations Report. The 7B2 report contains the obligated dollar values for the end items which are supported by the SSD initial spares.

2D1 and 7B2 Report Details

In the 2D1 Systems Support Stock Fund Status accounting data reports, we used the Material Program Code (MPC) to identify provisioning dollars. MPC codes beginning with '1P' identify inventory augmentation (initial spares) money. We also used the Control Symbol Number (CSN), a six digit code, to identify the application for the provisioning dollars. The first four digits of the CSN code equals the System Management Code (SMC) code or the last four numerics of the Class IV/V modification number. The fifth digit of the CSN shows the category of the provisioning dollars, as shown below:

- A = force modernization
- B = force modification
- C = readiness improvement

The sixth digit of the CSN shows the type requirement of the provisioning dollars, as shown in the figure below:

P = initial provisioning
R = replenishment

Only the funds whose CSN ends in 'P' are used to develop the factors.

In the H058 7B2 Status of Allotment/Allocations Report, the obligated dollars are broken out first by Budget Program (BP), second by SMC, and third by MPC. The report does not contain CSN codes. The MPC codes in the report identify end item use of BPAC funds and can be used to identify usage of funds for different commodity groupings. Each budget program has their own set of MPC codes. This is illustrated in Figure A-1.

**Material Program Codes (MPC)
For BP11 and BP16**

MPCs for BP11 (Aircraft Modifications) are:

- 1000 - Class IV mods
- 2000 - Class V mods

MPCs for BP16 (Aircraft Initial Spares) are:

- 1000 - BP10 PAIS (Prototype Advanced Indications System)
- 1100 - airborne (except engines)
- 1200 - peculiar AGE equipment
- 1300 - training devices
- 1400 - engines
- 1500 - provisioning documentation
- 1900 - other (many ECM here)
- 3000 - support equipment
- 4000 - mods
- 4100 - Class V mods
- 4200 - Class IV mods
- 4300 - provisioning
- 4400 - engines
- 4500 - documentation

Figure A-1

Data Results

2D1 Reports

For the 2D1 data, we were only interested in examining the inventory augmentation (provisioning) funds (MPCs of '1Pxx'). Previous to 1984, no standardized codes existed for CSN which stratified provisioning dollars (i.e., by force modernization, force modifications, etc.). Therefore, we cannot identify the appropriate funds use (for initial provisioning or replenishment) for the pre-1984 data to develop the factors.

When examining the CSN codes, SA-ALC, OC-ALC and OO-ALC consistently used

CSN codes for the fifth and sixth digit which were different than the codes given above. This is inconsistent with current policy as given in an LORF letter dated 4 May 1983 [3]. For example, SA-ALC almost never uses 'CR' as the fifth and sixth digit. They frequently use '00' (which is not policy) as well as others. No data was compiled for SM-ALC and WR-ALC. In talking to budget managers at OC-ALC, SA-ALC, and WR-ALC, they stated that we only needed to examine the 'AP' and 'BP' codes as they were the only ones that identified the appropriate provisioning dollars.

Another problem we identified is that each ALC examined didn't use a CSN for some of their items. We therefore could not trace these funds to their intended use (end item). For example, OC-ALC had \$450,918 in obligations with no CSN (30 Sep 88 2D1 report), and SA-ALC had \$8,311,959 in obligations with no CSN (30 Sep 88 2D1 report). In talking to budget managers at SA-ALC and OC-ALC, they stated that these data records were not necessary for developing the factor. They usually were last minute program changes and normally involved a small dollar amount when compared to the entire program.

Lastly, one anomaly exists in that each ALC's 2D1 report contains the last three years of data except for SM-ALC, which contains only the first two years. This is not a serious problem, except that the budget managers identified the last look (third year) at a program years dollars as being the most accurate.

7B2 Reports

The only problem with the 7B2 data is that it does not carry the majority of the data for BP10 (Aircraft Procurement) and BP20 (Missile Procurement). This data is retained by the Air Force Systems Command (AFSC). We have been able to obtain these reports from them.

Identifying Data by Commodity Group

Currently, AFLCR 67-7 specifies factors for the following commodity groups: airframe, engines, support equipment, electronics, and trainers/simulators. However, automated data sources do not allow for the development of these type of factors. The 2D1 data has no commodity group breakout. In the 7B2 (H058) data, breakouts exist for weapon system (by SMC code) and for commodity group (by the MPC code). Without a similar breakout in the 2D1 data, we cannot use the data to determine the factors as they currently exist (for airframe, engines, etc.). The best we can do is develop factors by the weapon system.

Provisioning and the Initial Support Period

Before a new weapon system is delivered to the Air Force (force modernization), SSD initial spares are procured for an initial support period (ISP). The ISP is the first 12 or 24 months of new weapon system deliveries (depending on the type of weapon system). The initial spares are ordered lead time away from the ISP so that they will be on-hand to repair and maintain the new weapon systems for the ISP period. During the ISP, using repair parts will create demand history from which we can compute requirements for future stocks.

Provisioning can also occur after the ISP for new weapon systems. For example, the Air Force has been procuring F-16 aircraft for over ten years now. The ISP for provisioning initial spares for the F-16 was for the first two years of aircraft deliveries. Afterward, the Air Force provisioned additional SSD spares for the new aircraft in what we call the "follow-on period." This ensures that we will have no shortages due to the demands created by the increasing aircraft inventory. Also, initial spares to support design change notices must be procured throughout the life of the weapon systems production and delivery to the Air Force.

Lastly, the Air Force continually makes modifications to weapon systems to correct or improve their capability. These modifications can start at any time: as early as the ISP and continuing throughout the life of the weapon system. Many of these modifications involve the use of spare parts that do not currently exist in stock. Therefore, we must make initial provisioning for force modifications. Figure A-2 illustrates this and the different types of provisioning presented above.

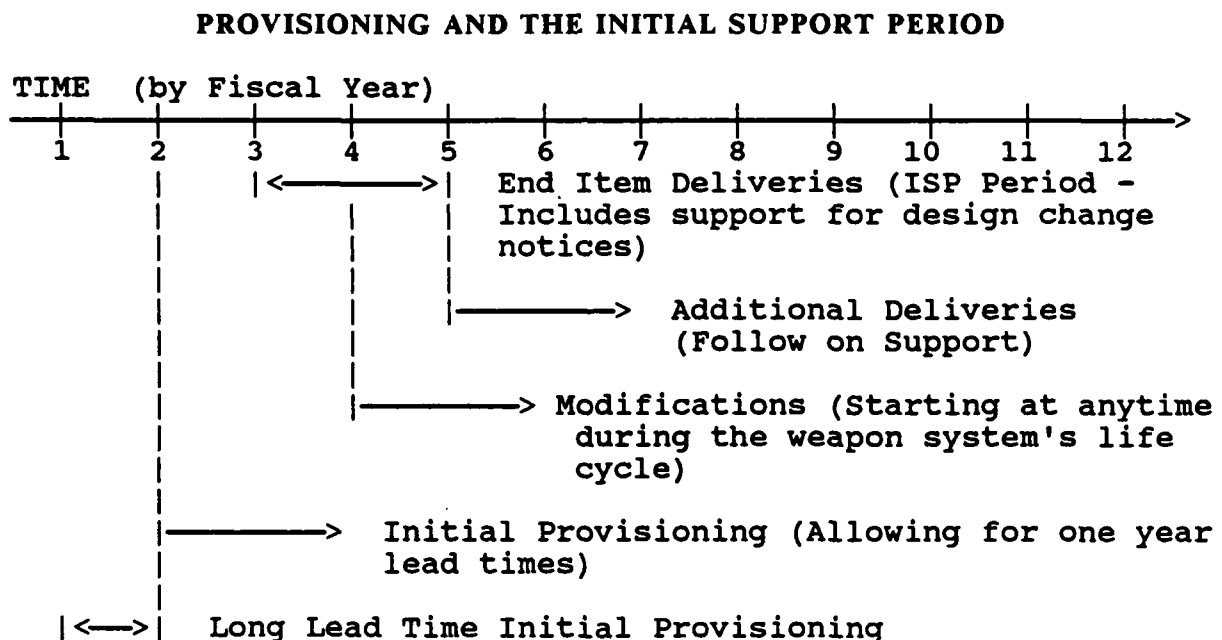


Figure A-2

The ISP is an integral part of using (and therefore of developing) the SSD initial spares factors. However, 2D1 and 7B2 data does not lend itself to developing factors for the ISP. There is no way to match the timing of the SSD initial spares provisioning dollars from the 2D1 reports to the end item data in the 7B2 reports. We also cannot identify what portion of the end item data is for the ISP period as opposed to later weapon system deliveries.

Summary

In the pre-1984 2D1 reports, we cannot identify the funds usage for provisioning dollars because no standardized policy existed at that time to identify these funds by the Control System Number (CSN) code. When the policy was standardized for the 1984 reports, we found that the usage of codes for the fifth and sixth digits of the CSN code is inconsistent with policy. However, the SSD budget managers stated that we only need to examine provisioning items with CSNs whose fifth and sixth digit end with 'AP' or 'BP.'

Other problems we identified in the accounting reports are as follows. In the 2D1 reports, a small percentage of provisioning items have no CSN code. We also found that SM-ALC's 2D1 report contains only two years worth of data, while the other ALCs contain three years. As for determining the SSD spares projection factors by commodity groups, we found that this is not possible with the 2D1 reports. Finally, for the 7B2 and 2D1 reports, we cannot identify what portion of the end item data is for the initial support period (ISP) as opposed to later weapon system deliveries.

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